

## SUBJECT INDEX

### A

A stars, peculiar, 2  
Abell clusters, 276, 632-34  
binary, 288  
catalog of, 635-37  
distance distribution of, 636-37  
richness distribution of, 636-37  
space density of, 637, 639-49  
spatial correlation function of, 640-49, 653  
superclusters of, 265-71, 273-74, 663-67  
surface distribution of, 637-639  
voids near, 266-71, 273-74

Abell 160, 110  
Abell 370, 607  
Abell 1367, 251-52, 255-56  
Abell 2147, 252-53, 255-56  
Abell 2151, 252-53, 255-56  
Abell 2152, 252-53, 255-56  
Abell 2199, 253, 255-56  
Accretion disk, solar, 441, 447, 449-53. See also Solar nebula, primitive

ACRIM (Active Cavity Radiometer Irradiance Monitor), 473, 476-78, 485-86, 494  
97

Active galactic nuclei  
infrared emission in, 348-50, 352, 356-57, 360-62, 369, 371-72  
polarization in, 118-24, 138  
rotation measures of, 122  
synchrotron emission in, 95, 118-20

Apollo lunar landings, 465-66

Arg 148, 364

Arg 220, 344, 349, 352, 362, 364

Arg 299, 352, 355, 363-64

Astrometric detectors, see Detectors, astrometric

Astrometric measurements, corrections to, 433

Astrometric Telescope Facility, 429

Astrometry, 413-40  
archives of, 433-34  
computer use in, 436-37  
ground vs. space, 430-31  
optical, intercompared with radio, 431-33

photographic, 418, 424  
measuring engines for, 428-29  
satellites for, 429-30

Asymptotic Giant Branch phase, 230-33, 239, 445

### B

B stars, 5-6  
as progenitors of Type II supernovae, 312

Baade's window, 53-83

Baryonic matter model of the Universe, 679-80

Binary stars, 447  
as blue straggler precursors, 213-15  
as supernovae progenitors, 311-12, 323, 336

BL Lacertae, 126, 128, 130-34

Blazars  
polarization in, 119-23  
variability of optical, 130-33

Boötes, void in, 259-63, 266, 668-69

BY Draconis-type variable star, 504

### C

Cape Photographic Catalog-2, 417

Cassiopeia A, 302, 308, 317, 329

Centaurus A, 117, 120

IV Cepheus, 384

Charge-coupled devices, use in astrometry of, 419-26, 428, 432-37

Chondrites, 453

Chondrules, 453-55, 459-60

Cold dark matter model of the Universe, 679-81

Color-magnitude diagrams of globular clusters, 199-244

Asymptotic Giant Branch of, 230-33

horizontal branch of, 224-30  
lifetime of stars on, 224-26  
luminosity of stars on, 226-29

mass-loss rates of stars on, 229-30

main-sequence stars on, 206-15  
turn-off region of, 209-13

post-Asymptotic Giant Branch phase of, 233-37

red giant branch of, 218-24, 229-30  
luminosity function of, 219-21

subgiant branch of, 215-18  
white dwarf phase of, 233-38

Coma cluster of galaxies, 247-48, 250-52

luminosity function of members of, 515-16, 536, 543, 549-50

mass anomaly in, 284

Coma/A1347 supercluster, 252, 255, 269  
void in, 253, 255-58, 262, 273

Comet Giacobini-Zinner, 11-12, 29, 38, 42, 44

Comet Halley, 11-12, 44-45  
dust in, 15, 21-25  
dust mantle of, 17-19  
dust tail of, 21-23  
gas in, 25, 29-36  
ionopause of, 33-34, 40-42  
mass of, 15  
nucleus of, 13-21  
chemical composition of, 15-36  
jets in, 13-15, 19, 23  
topography of, 12-15, 19-21

rotation period of, 15, 19-21  
solar wind interaction with, 36-44  
tail of, 21, 25, 37-39

Comets, 11-49  
dust in, 17-28, 31-32  
dust tails of, 21-22  
formation of, 469-70  
gas in, 25-36  
ionopause of, 33-34, 38, 40-42  
magnetic fields in, 36-46  
nuclei of, 13-21, 26-36, 45  
abundances in, 17  
chemical composition of, 12, 15-17, 21-23  
dust mantles on, 17-19, 27, 45  
gas in, 26-36  
icy conglomerate model of, 13, 21  
jets in, 13-15, 19, 21-23  
solar wind interaction with, 12, 36-46  
tails of, 21, 36-37

temperatures of, 33–35  
velocities of, 33

Cosmic blackbody radiation, see  
Microwave background  
radiation

Cosmic microwave background, see  
Microwave background  
radiation

Cosmic strings, 659–60, 682

Cosmology, 561–630  
hot big bang theory of, see  
Hot big bang theory  
importance of luminosity  
function of galaxies to,  
510–14

Standard model of, 561–65  
observational tests for,  
563–65  
time-scale test for, 563,  
565, 617–23

Crab Nebula, 318, 326, 329

CTA 21, 104

Curvature of space, 513–14,  
563–71, 585–86

Cygnus A, 114, 117

Cygnus OB2 association, 153,  
160

Cygnus superbubble, 153, 181

D

Dark matter, 282, 288–89, 623

Dendograms, identification of  
voids using, 266–67, 276–  
78

Detectors, astrometric, 413–40  
Carlsberg automatic meridian  
circle, 427  
charge-coupled devices, 419–  
26, 428, 432–37  
combined-function, 420–24,  
432  
large-angle, 414–15, 427–28  
MAMA (Multi-Anode Micro-  
channel Array), 419,  
424–26, 435

MAP (Multichannel  
Astrometric Photometer),  
422–23, 425

optical interferometers, 419

photoelectric, 418–19, 422–  
24, 427–28, 434–35

photographic, 418, 424, 428–  
29

photon, 418–19, 434–35  
calibration of, 424–25  
modes of operation of,  
420–21  
systems of, 421–24  
scan operation of, 420, 423,  
427, 432

separated-function, 420–424,  
427

small-angle, 414–16, 434  
stare operation of, 420–22  
supercalibration of, 424–25

30 Doradus nebula, 154

DQ Herculis, 395

Dynamics Explorer I, 11

E

Earth  
atmosphere of, 468  
climate of, 501–2  
formation of Moon and, 465–  
66  
fossil effects on, as indica-  
tions of Sun's varia-  
bility, 500–1

F

FH Serpentis, 379, 396

Fifth Fundamental Catalog, 417

Fornax cluster of galaxies, 523,  
537, 541, 544

FU Orionis, 449, 451–52

G

Galactic bulge, 51–92  
ages of stars in, 60–63, 87  
balloon mapping of, 85–87  
color-magnitude diagram for  
stars in, 60–63  
discovery of, 52–54  
infrared colors of giant stars  
in, 59–60, 64–67  
inner, 84–87  
IRAS sources in, 56–57, 62–  
63, 74–82

K giants in, 54, 58–60, 70,  
82

latitude-dependence of types  
of stars in, 63–67, 76–78

light distribution in, 80–87

long-period variables in, 53,  
56–57, 62–63, 74–76,  
79, 81–82

luminosities of stars in, 60–63

M giant stars in, 56–60, 64–  
71, 75–76, 79–82, 85–87

mass of, 52

metallicity of stars in, 54–67,  
87–88

RR Lyrae stars in, 53–56

stellar distribution in, 80–89

stellar population of, used in  
stellar synthesis models,  
67–74

surface brightness of, 80–87

Galactic center, 52–53, 84, 87

distance to, 53, 55

interstellar matter in, 79, 84

OH/IR stars near, 84

star formation in, 52, 84–85

Galactic differential rotation, su-  
perstructure evolution and,  
171–73

Galactic disk, collision of high-  
velocity clouds with, 178–  
82

Galaxies  
absolute magnitudes of, 511–  
12, 520–22  
cluster, 523–25  
field, 525–27

angular size-redshift relation  
for, 565, 609–17

apparent magnitudes of, 511–  
13, 519–22, 553–55

cluster, 523–25

corrections to, 577–79,  
593–96

field, 525–26

classification of, 3, 6–8, 554–  
55

cluster membership of, 660–  
62

color evolution in, 602–5

correlation function of, 642–  
45, 658–62, 671

count-magnitude relation for,  
581–90

counts of, 571, 584–90

density function of, 517–19,  
526–33

distribution in space of, 246,  
258–62, 670–71

dust in emission in, 344–50

evolution of, tests for, 600–9

formation of, 512–13, 556–57

giant-to-dwarf ratio of, 512–  
13, 538, 554

with high redshifts, 593–600,  
634, 671

infrared emission in centers  
of, 343–76

infrared luminosity morpholo-  
gy of, 358–64

luminosity evolution of, 579–  
80, 587–89, 598–600,  
607–9

luminosity function of, see  
Luminosity function of  
galaxies

luminosity function-density  
relation in, 549–50

masses of, 283–88

morphology-density relation  
in, 510, 548–49

photoionized gas in emission  
in, 350–55

point-smoothing analysis of,  
278–79

polycyclic aromatic hydrocar-  
bon molecules in emis-  
sion in, 349–50

redshift distribution of, predicted, 511-12

redshift-distance relation for tests of linearity of, 590-93

redshift-magnitude relation for, 576-81, 592

redshift surveys of for luminosity function determinations, 515-16 for void identification, 246-62

rigid-rod measurements of, 609-17

shell model distribution of, 662-63

shock-heated gas in infrared emission in, 353, 355-58

spectral energy distribution in, 578-79, 601-6

starburst activity in, 607

statistical probability studies of, 273-76

supershells in, see Super-shells, galactic

surface distribution of, 249-55, 584-86

young stars in, 345-57

Galaxies, barred, 362

Galaxies, binary supergiant, 287-88

Galaxies, blue compact dwarf, 523, 541-43, 546

Galaxies, cD

identification of, 8

luminosity functions of, 534-37, 543

Galaxies, cluster

luminosity functions of, 509, 514-16, 523-25, 533-37, 540-47

metric diameters of, 615-17

Galaxies, clusters of

Abell

distance distribution of, 636-37

richness distribution of, 636-37, 656-58

space density of, 637-39

surface distribution of, 637-39

catalogs of, 635-39

classification of, 595-96

clustering of, 639-54. See also Galaxies, superclusters of

cross-correlations with galaxies of, 647, 651-53

dendrogram analysis of, 266-68, 276-78

density-morphology relation for, 510, 547-52, 555-56

distribution in space of, 631-86

redshift elongation of (Finger-of-God effect), 673-79

masses of, 284-89

morphological evolution in, 606-7

peculiar motions of, 672-79

polarization in, 136

spatial correlation function of, 639-60

dependence on cluster richness of, 656-58

survival times of members of, 286-88

X-ray observations of, 653-54

Galaxies, dE

luminosity functions of, 512-13, 541, 544-49, 554

stellar content of, 72-73

surface density of, 512-13

Galaxies, dwarf

luminosity function of, 514-15

mass of, 285

Galaxies, elliptical, 592, 602, 615

luminosity function of, 515, 540-44, 549, 554

spectral energy distribution of, 578-79, 604-6

starburst activity in, 607

stellar content of, 68-72, 79

Galaxies, field, luminosity functions of, 509-10, 515-16, 525-33, 537-43

Galaxies, groups of, luminosity functions of, 531-33

Galaxies, Im, luminosity functions of, 513, 541, 546-47, 554, 556

Galaxies, interacting, 357, 363-64, 369

Galaxies, irregular, luminosity functions of, 541, 545-47

Galaxies, S0

luminosity functions of, 540-43, 549

masses of, 285

spectral energy distribution of, 578-79

stellar content of, 68-69

Galaxies, spheroidal, stellar content of, 52-89

Galaxies, spiral

luminosity function of, 541, 545-49

stellar content of, 68-69

Galaxies, star-forming, 343-79

dust in emission in, 344-50

infrared morphology of, 358-64

photoionized gas in, 350-55

shock-heated gas in, 351-58

Galaxies, superclusters of, 632-33, 639-40

catalogs of, 662-67

elongation of, 678

membership of, 662, 667

spatial correlation of, 654-56

voids and, 246-53, 662-70

Galaxy, see also Milky Way

age of, 619-20

bulge of, see Galactic bulge

inner bulge of, 84-85

inner spheroid of, 83-84

mass of, 283

polarization in, 99-100, 114-16

spiral arms of, 3, 5-6

star formation in, 343, 345, 348-49, 352

supernova rate in, 183-84, 312-13

supershells in, 145-53

Galaxy-cluster cross correlation, 647, 651-53

Galaxy count-magnitude relation, 576, 581-90

Galaxy count-redshift relation, 571-76

Giotto spacecraft, 13, 20, 29-32, 36, 39-41

GK Persei, 404

Globular clusters

Asymptotic Giant Branch

stars in, 230-33, 239

binary stars in, 214-15

blue stragglers in, 213-15

color-magnitude diagrams for, 199-244

evolutionary sequences in, 199-244

horizontal branch stars in, 224-30, 238-39

lifetime of, 224-26, 239

luminosity of, 226-29

mass-loss rates in, 229-30

long-period variable stars in, 231-33

luminosity functions in, 200, 203, 206-9, 216-21, 237

main sequence stars in, 206-15, 238

lower, 206-9

luminosity function of, 206-8

turnoff in, 209-13

upper, 209

mass-loss of stars in, 229-33

metallicity of stars in, 60, 62, 208, 210-11, 216-20, 232-33

post-Asymptotic Giant Branch phase of, 233-39

present mass function of, 206-8, 238  
pulsars in, 214  
red giant branch stars in, 218-24, 238  
helium flash in, 223-24  
luminosities of, 221-23, 230  
luminosity function of, 219-21

RR Lyrae stars in, 228-29  
stellar population of, 57-58, 201-5. See also individual stellar types  
subdwarfs in, 210-211  
subgiants in, 215-18, 238  
white dwarf evolutionary phase of, 233-38

Gould's belt, 147, 171  
GQ Muscae, 379, 383  
GS 061-0+51, 146  
GS 081-05-37, 153  
GS 120-30-8, 152  
GS 155+38-58, 152  
GS 174+02-64, 152  
GS 203+02-11, 160  
GS 331+14-15, 151-52, 177  
Gum Nebula, 99, 153  
G 0.9+0.1, 331-32  
G 5.3-1.0, 323, 332  
G 18.9-1.1, 332  
G 20.0-0.2, 332  
G 24.7+0.6, 332  
G 27.4+0.0, 335  
G 34.6-0.5, 332-33  
G 39.7-0.2 (W 50), 322, 326, 335-36  
G 41.4+0.4, 333  
G 54.1+0.3, 333  
G 68.9+2.8, 333, 336  
G 109.1-1.0, 336  
G 263.9-3.3 (Vela XYZ), 333-34  
G 291.0-0.1, 334-35  
G 292.0+1.8, 318  
G 293.8+0.6, 335  
G 308.7+0.0, 335  
G 320.4-1.2, 336  
G 332.4-0.4, 336-37  
G 357.7-0.1, 323

## H

H I  
distribution of, 159, 184  
high-velocity clouds of, 178-82, 192  
shells, 146-54  
star formation and, 154, 189-91  
supershells, 153-56, 162-63, 172, 177

H II regions  
evolution of, 188-92  
infrared emission from, 349-54, 360, 363  
and spiral arms, 5  
supershell formation and, 146-47, 153-58, 173-77, 186

Halley's comet, see Comet Halley

HEAO observations, 153

Helium flash, 223-24

Hercules/A2199 supercluster, 253

void in, 253, 255-58, 262-63, 273

High-velocity clouds, supershells and, 178-82, 192

HIPPARCOS, 414-16, 430-32

Input Catalog of, 417

HIPPARCOS-II, 429

Hot big bang theory of cosmology, 561-630

space-curvature requirement for, 565-71

tests for, 562-65

angular size-redshift relation, 565, 609-17

galaxy count-distance relation, 564-65, 571-76

galaxy count-magnitude relation, 576-90

redshift-distance relation, 563, 590-600

redshift-magnitude equation, 576-81

time-density, 563, 590-609

time-scale comparison, 563, 565, 617-23

Hot dark matter model of the Universe, 681

HR Delphini, 384, 397, 403

Hubble constant, 246, 512, 526, 617-18, 621-23, 634

Hubble diagram, 576-77, 579-80, 590-600

at large redshifts, 593-600

in near infrared, 596-98

Hubble Space Telescope, 205, 237, 414-16, 530-32

Guide Star Catalog of, 416

Hubble time, 623

## I

IC 10, 156  
IC 342, 362  
IC 433, 353  
IC 698 group of galaxies, 285  
IC 4296, 109  
IC 5063, 120

ICE (International Cometary Explorer), 11, 29

Infrared emission

star-formation rates in galaxies and, 369-71

in star-forming galaxies, 343-76

constituents of, 344-58

mapping of near-, 363-64

morphology of, 358-64

radio emission correlation with, 364-65

Infrared observations

of novae, 377-412

solar, 481-83

IRAS observations

of Galactic bulge sources, 56-57, 62-63, 74-82

of star-forming galaxies, 344, 348-49

International Halley Watch, 11

Interstellar clouds, origin of Sun and, 442-48, 452-53, 460-61, 469

Interstellar gas, collapse of, in formation of Sun, 446-48

Interstellar grains, planetesimal formation from, 456-57

Interstellar magnetic field, 444-47, 454

Interstellar matter

content of, 183-84

star formation and, 184-92

superstructures and, 183-92

Interstellar medium

in center of Galaxy, 79, 84

nova explosions and, 404

Interstellar radiation field, 348

IUE satellite observations, 11, 17, 19, 72

## J

Jets

in extragalactic radio sources, 108-18, 129-30, 138

in nucleus of Comet Halley, 13-15, 19, 23

in supernova remnants, 296, 326

Jupiter, formation of, 461-65

## K

K stars, giant, in Galactic bulge, 54, 58-60, 70, 82

Kepler's supernova, 297, 302, 314, 328

Kuiper Airborne Observatory, 11, 25, 30, 369

## L

Lacerta OB1 molecular cloud, 187  
 Lacertids, 126-28, 130-34  
 Large Magellanic Cloud  
   supernova in, 295, 300-3, 309  
   supershells in, 146, 153-54  
 Lick Northern Proper Motion  
   Program, 417  
 Lindblad bubble, 147  
 LINER galaxies, 351, 361-62  
 Local Supercluster, 255-58, 264-65, 269, 584  
 Local Group, 265, 271, 281, 514, 526, 545  
 Long-period variable stars  
   in Galactic bulge, 53, 56-57, 62-63, 74-76, 79, 81-82  
   in Globular clusters, 231-33  
 Look-back time, 510, 513-14, 564, 580-81, 600-9  
 Luminosity function of cluster  
   galaxies, 509, 533-37, 540  
   determination of, 514-16, 523-25  
 Luminosity function of field  
   galaxies, 509-10, 515-16, 525-33, 537-43  
   determination of, 525-33, 537-43  
   c-method, 531  
   classical method, 517, 528, 533  
   for groups of, 532  
   maximum likelihood  
     methods, 529-30  
      $\phi$   $\Phi$  method, 528-29, 533  
 Luminosity function of galaxies, 509-60, 579, 581-84  
 blue compact dwarf, 523, 541-43, 546  
 cD, 534-37, 543  
 dE, 512-13, 541, 544-49, 554  
   defined, 517-19  
   determination of, 522-33  
   elliptical, 515, 540-45, 549, 554  
   general, 509-10, 514-16  
   importance of, for cosmological studies, 510-14, 556  
 Im, 541, 546-47, 554, 556  
 irregular, 541, 545-47, 554, 556  
 selection effects of, 521-22  
 S0, 540-43, 549-50  
 spiral, 541-42, 545-49  
 universality of, 517, 540, 547

Luminosity function of globular  
   clusters, 200, 203, 206-9, 217, 219-21, 237  
 LW Serpentis, 382-83, 385-86, 388, 396

## M

M stars  
   dwarf, in Galactic bulge, 73  
   in galaxies, 68  
   giant, in Galactic bulge, 56-60, 64-66, 70-71, 75-76, 79-82, 86  
   supergiant, in Galactic bulge, 63  
 Magellanic Clouds, see also  
   Large Magellanic Cloud  
   Small Magellanic Cloud  
   globular clusters in, 202  
   supernova remnants in, 313-14  
   superstructures in, 182, 185  
 Magnetic field  
   intergalactic, 136  
   interstellar, 444-47, 454  
   of Sun, 498, 502-3  
 Main sequence turnoff, 209-13  
 Mark III stellar interferometer, 415  
 Mars, 463, 467-69  
 Mass anomaly, 283-89  
 Mercury, 461, 467  
 Meteorites, 399, 453-54, 459-60, 462  
 Microwave background radiation, 137, 264-65, 273, 281-82, 561-62, 564, 633, 672  
 Milky Way, see also Galaxy  
   infrared emission in, 345, 348-49, 352, 354-55  
 MKK (and MK) system of spectral classification, 3-6  
 Molecular clouds  
   cores of, and formation of solar system, 443-47, 453-54, 460  
   formation of, 147, 186-92  
 Moon, origin of, 465-68  
 MAMA (Multi-Anode Microchannel Array), 419, 424-26, 435  
 MAP (Multichannel Astrometric Photometer), 422-23, 425-26  
 M3, 202, 214, 218, 238-39  
 M4, 214  
 M13, 207  
 M15, 208  
 M28, 214  
 M30, 208

M31, 67, 73  
   infrared emission in, 79-80, 345, 348  
   stellar population of, 52-54  
   supernova remnants in, 313  
   supershells in, 155  
   surface brightness of, 82-83  
 M32, 52-53, 72-73  
 M33, 155-56, 313  
 M51, 351, 361  
 M81 group of galaxies, 545  
 M82  
   infrared emission in, 344-45, 350-54, 356, 358, 371  
   morphology of, 359-60, 363  
   star formation in, 345, 365-69, 371  
   supernova remnants in, 313, 328, 366-69  
   supershell in, 146  
 M83 (NGC 5236)  
   infrared emission in, 351-52, 354, 359  
   morphology of, 359, 362-64  
   star formation in, 352  
   supernova in, 306, 308  
 M87, 110, 118, 131  
 M100, 303-6  
 M101, 156, 172, 182

## N

Neptune, 464  
 Neutrinos, extra-solar system, 302  
 Neutron stars, 302-3, 319  
 NGC 55, 156  
 NGC 205, 52  
 NGC 206, 155  
 NGC 288, 221  
 NGC 253, 345, 351, 359, 363  
 NGC 891, 307-8  
 NGC 1052, 120  
 NGC 1068  
   morphology of, 359-61  
   polarization in, 118  
   infrared emission in, 344, 348-50, 352, 354-57  
 NGC 1097, 351, 361-62  
 NGC 1265, 108, 110, 114, 120  
 NGC 1275, 355  
 NGC 1808, 361  
 NGC 1866, 202  
 NGC 2623, 364  
 NGC 2903, 351, 359, 364  
 NGC 3227, 355  
 NGC 3310, 360, 363, 365  
 NGC 4151, 352, 355-56  
 NGC 4258, 307  
 NGC 4321, 303-6  
 NGC 4449, 156, 313, 359, 362-63

NGC 4736, 83  
 NGC 5128, 359  
 NGC 5194, 361  
 NGC 5236, see M83  
 NGC 5253, 353, 359  
 NGC 6240, 349, 353, 355-57  
 NGC 6251, 113  
 NGC 6356, 54  
 NGC 6397, 208  
 NGC 6522, 53-54, 57  
 NGC 6752, 221, 230  
 NGC 6946, 146  
 NGC 7469, 355-56, 362  
 Nimbus-7, 476  
 North Polar Spur, 151-52, 177  
 Nova Herculis 1987, 379, 384, 393, 397  
 Nova Serpentis 1970, 395  
 Nova Vulpeculae 1987, 384, 397  
 Novae, 377-412  
 abundances in ejecta of, 394, 398-99  
 constant-luminosity phase of, 405  
 coronal emission phase of, 393-95  
 distance (expansion parallax) of, 399-400  
 dust formation in ejecta of, 395-403  
 dust shells of, 379-84, 396-97, 400-3, 405  
 fireball expansion phase of, 379, 385-87, 399-400  
 grain formation in, 400-5  
 infrared forbidden-line emission in, 393-95  
 infrared studies of, 377-412  
 interstellar medium and, 399, 401, 404  
 light echoes from eruptions of, 403-5  
 mineral composition of grains in, 397-98  
 optically thin gas emission phase of, 387-95  
 polarization measurements of, 396  
 remnants of, 378, 394, 405  
 shells of old, 399-400  
 thermal bremsstrahlung in, 390-93, 399  
 NQ Vulpeculae 1976, 379, 382, 385-86, 395-96, 399

O  
 O stars  
 Galactic spiral structure and, 5-6  
 infrared emission in, 350-51  
 supernovae generated by, 312

superstructures and, 157-58  
 OAO-2 observations, 579  
 OB associations, supershells and, 146-47, 151-59, 185-88  
 OH/IR stars, 74-75, 84  
 OJ 287, 124, 131-35  
 Omega Centauri, 202, 221  
 Oort cloud, 469-70  
 Orion OB 1 molecular cloud, 180-81, 187  
 I Orionis association, 153, 158  
 OS Andromedae, 384

P

I Perseus association, 177  
 Perseus OB 2 molecular cloud, 187  
 Perseus-Pisces void, 263  
 Pictor A, 118  
 Pioneer Venus Orbiter, 11  
 Pisces-Cetus supercluster, 269-71  
 Planetary collisions, 461, 465-67  
 Planetary nebulae, 61, 234  
 Planetesimal accumulation, 399, 456-63, 468-69  
 Planets  
 atmospheres of, 467-69  
 formation of, 441, 448-50, 460-69  
 satellites of, 465-67  
 Pluto, 467  
 Polarization  
 in clusters of galaxies, 136  
 of the cosmic microwave background, 137  
 in extragalactic radio sources, see Radio sources, extragalactic, polarization in  
 Faraday effect in, 96-99  
 in quasars, 100-2, 106-122, 134-35  
 variability of, 125, 128, 131  
 Stokes parameters for, 94-95  
 in Universe, 136-37

Pulsars  
 in globular clusters, 214  
 as supernova remnants, 308, 310, 312, 326, 329, 336

Puppis A, 318  
 PW Vulpeculae, 379, 383-85, 395-96, 403-4

Q

QU Vulpeculae, 379, 384, 393-94, 396-98, 404

Quasars  
 clustering of, 634, 671-72  
 distances of, 265, 271-72  
 polarization in, 100-2, 106-22, 134-35

R

Radio emission  
 relation to infrared emission, in galaxies, 364-65  
 variability of solar, 474, 484

Radio galaxies  
 compact, 106-7  
 Hubble diagram for, 598  
 polarization in, 100-2, 106-18

Radio sources, extragalactic, 8  
 circular polarization in, 103-6  
 depolarization in, 98-102, 113-17  
 distribution of polarized emission in, 106-18  
 halos in, 116  
 high redshifts for, 614  
 magnetic field structures in, 108-13, 123-24  
 optical polarization in, 118-24, 130-35, 138  
 polarization in, 93-144  
 polarization in jets in, 108-17, 138  
 polarization-redshift correlation in, 100-2  
 polarization rotator events in, 127-29  
 polarization variability in, 125-30, 130-35  
 rotation measures in, 113-17, 122  
 synchrotron emission polarization in, 95-96  
 Radioactivities, extinct, 399, 442-46  
 Rigid rods, 609-17  
 RR Lyrae stars  
 in Galactic bulge, 53-56  
 in globular clusters, 226-28  
 RS Ophiuchi, 404

S

S Andromedae, 297  
 Sagittarius star clouds, 52-53, 55  
 Sagittarius I window, 57, 63, 74, 78  
 Saturn, formation of, 461-62, 464-65  
 Scorpius OB 1 association, 158, 160  
 Shectman clusters  
 catalog of, 638-39, 670

spatial correlation function of, 649–50, 653

Seyfert galaxies  
infrared emission in, 344, 348–52, 355–56, 359–61

polarization observations of, 118, 120, 123

Shells  
Galactic, 146–53  
H I, 146–54  
origin of, 178–81

Sk –69°202, 302

Small Magellanic Cloud, super-shells in, 146, 154–55

SN 1006, 314, 328

SN 1054 (Crab Nebula), 318, 326, 329

SN 1572 (Tycho's supernova), 314, 328

SN 1604 (Kepler's supernova), 297, 302, 314, 328

SN 1670 (Cas A), 302, 308, 317, 329

SN 1950B, 308–9

SN 1957D, 308–9

SN 1961V, 308–9

SN 1970G, 303

SN 1979C, 303–6, 308, 310–11

SN 1980K, 308

SN 1981K, 307

SN 1983N, 306

SN 1986J, 307–10

SN 1987A, 295, 300–3  
radio emission from, 309

Solar constant, 476  
Earth's climate and, 501–2

Solar flares, 496–97, 500

Solar irradiance  
infrared observations of, 481–83  
measurements of total, 476–79  
rotation modulation of, 479–81, 488–89  
secular changes in, 496  
variability of,  
radio, 474, 484  
ultraviolet, 479–81, 489  
X-ray, 474, 483–84, 492–93

Solar magnetic cycle, variations in the, 489–93

Solar Maximum Mission, 11, 473–78

Solar nebula, primitive. See also Sun, origin of  
flare activity in, 454–55, 462  
formation of, 441, 448–51  
formation of planetesimals in, 456–61  
formation of planets in, 460–69  
gas in, 461–65

magnetic activity in, 453–56

Solar neutrinos, 497

Solar oblateness, 499–500

Solar rotation, 500

Solar system, origin of, 441–72

Solar wind, interaction with  
comets of, 12, 36–46

Spectral classification, 3–6

SS 433, 322, 326, 336

Star formation, 343–76, 441–56.  
See also Galaxies, star-forming.  
accretion disk phase of, 448–51  
collapse of interstellar gas in, 446–48

in elliptical galaxies, 69, 72

in Galactic center, 52, 84–85

in Large Magellanic Cloud, 153–54

rates of, 190, 369–71  
in Galaxy, 188

supershell formation and, 147, 153–59, 172, 184–92

Star-forming regions, sizes of, 359, 371

Stars  
A-type, see A stars  
accretion binary, 311–12, 323, 336  
ages of, 60–63, 87  
astrometric measurements of, 413–40  
Asymptotic Giant Branch, 445  
in globular clusters, 230–33, 239

B-type, see B stars

binary, see Binary stars

blue stragglers, 213–15

blue supergiant, 295, 309

cataclysmic variable, 449, 451

dwarf, 72–73

giant, 54–60, 64–66, 75–76, 79–82, 86

horizontal-branch, in globular clusters, 224–30, 238–39

K-type, see K stars

long-period variable, see Long-period variable stars

M-type, see M stars

main sequence  
in Galactic bulge, 60–61  
in globular clusters, 206–15

metallicity of, 54–67, 87–88

O-type, see O stars

post-Asymptotic Giant Branch, 233–39

subdwarf, 210–11

subgiant, 215–18, 238

supergiant, 5, 63, 157–58, 295, 309

Stellar clusters, supershell origin and, 151, 156–59

Stellar evolutionary sequences, 199–244

Stellar synthesis models, 67–74

Stellar winds, 147, 154, 157–63, 173–74, 181–82

Stokes parameters, 94–95

Suisei spacecraft, 19, 39

Sun  
accretion disk of, see Solar nebula, primitive  
emission-line variability in spectrum of, 478–79

faculae in, 485, 488, 502–3

g-mode oscillations in, 496–97

granulation in, 494, 498–99

limb darkening of, 500

magnetic field of, 489–93, 498, 502–3

magnetic loops in, 483–84

origin of, 441–48, 451–56  
molecular cloud hypothesis for, 443–53, 469–70

supernova trigger hypothesis for, 443, 446–47

oscillations in, 494–95

power spectrum of, 494

variability in radius of, 499

variations in luminosity of, 473–507. See also Solar irradiance  
contributors to, 484–97  
fossil effects at Earth as indications of, 500–1  
rapid, 502–3  
thermal diffusion theory of, 502–3

Sunspots, 485–88, 498–99, 502–3

Superbubbles, 145, 152–53, 181

Superclusters, 246–62, 265–71.  
See also individual superclusters  
shells of, 263–65

Supernova explosion, formation of solar system from, 443–47

Supernova explosions, formation of expanding shells from, 146–47, 157–71, 181–84, 190–91

Supernova rate, 158–59, 312–13  
of discovery, 312–13  
in M82, 365

Supernova remnants, 296, 313–41

Balmer-dominated, 296, 314–15, 326, 330–31

centrally influenced, 322-23, 335-36  
 classification of, 296, 314-15  
 distances of, 327-28  
 evolution of, 326-28  
 evolved, 296, 314-15, 321-22, 331  
 extragalactic, 313, 328  
 Galactic, 314-25  
 jets in, 296, 326  
 in M82, 313, 328, 366-69  
 number-linear diameter relation for, 327-28  
 oxygen-rich, 296, 314-15, 326, 329, 331  
 plerionic-composite, 296, 314-15, 318-21, 326, 329, 331-35  
 as radio sources, 308-9  
 relations for, 327-28  
 supershells and, 146-54, 162-72  
 surface brightness-linear diameter relation for, 327-28  
 as X-ray sources, 296, 335  
 Supernova-supernova remnant connection, 328-31  
 Supernovae, 295-313  
 classification of, 295-98  
 origins of, 311-12  
 radio, 295-98, 303-11, 328, 330  
 miniplerion models for, 310  
 minishell models for, 310-11  
 intermediate age, 308-9  
 Type I  
 optical, 295, 297-300, 311-13, 328-31  
 radio, 306  
 Type II, 295, 300-3, 305-8, 311-13, 329-31  
 absolute magnitudes of, 300  
 clustering in space of, 157, 184  
 variability of, 300  
 Supershells, 145-97. See also Shells, Superstructures  
 effect of stellar radiation pressure on, 177-78  
 formation of, by galactic disk-cloud collision, 178-81  
 Galactic, see Shells, Galactic  
 H I, 146-56, 162-63, 172, 177, 181, 183-84, 186, 189-91  
 H II regions and, 146-47, 153-58, 189  
 kinetic energy of, 154, 182  
 in Large Magellanic Cloud, 146, 153-54  
 origin of, 178-81  
 radii of, 146, 150-54  
 star formation and, 147, 153-59, 172, 184-92  
 stellar associations and, 146-47, 151-59, 185-88  
 supernova remnants associated with, 146-54, 162-72  
 Superstructures, see also Shells, Supershells  
 effects of galactic differential rotation on formation of, 171-73  
 energy sources of expanding, 156-83  
 H II regions, 146-47, 153-58, 173-77, 186  
 stellar winds, 147, 154, 157-63  
 supernova explosions, 146-47, 157-71, 181-84, 190-91  
 in nearby galaxies, 155-56

T

Transit circles, 427-28  
 47 Tucanae, 208, 217, 220, 233  
 Tycho's supernova, 314, 328

U

UBV system, 3, 6  
 Ultraviolet radiation from elliptical galaxies, 71-72  
 solar, 479-81, 489

Universe age of, 618-20  
 dark matter in the, 282, 288-89, 623  
 hot big bang theory of origin of, see Hot big bang theory of cosmology  
 large-scale structure in, 631-86. See also Galaxies, clusters of, Galaxies, superclusters of, Voids  
 explosion model of, 682-83  
 models for, 679-83  
 polarization in, 136-37  
 standard model for origin of, see Cosmology, standard model of

Uranus, 464-65, 467

V

VEGA spacecraft, 13, 15-20, 22, 24-25, 29-30, 39

W

Vela XYZ, 333-34  
 Venus, 468-69  
 Virgo A, 114  
 Virgo cluster of galaxies luminosity function of members of, 516, 521-23, 526, 537, 541-50, 554-55  
 mass anomaly in, 284  
 VLA, astrometric programs with, 431  
 VLA observations of extragalactic radio sources, 114, 120-21, 137-38  
 of novae, 384  
 of supernovae, 303, 306-9  
 VLBI observations of extragalactic radio sources, 121, 123-24, 138  
 of supernovae, 306, 308, 310  
 Void in Bootes, 259-63, 266, 668-69  
 in Coma/A1347 supercluster, 253, 255-58, 262, 273  
 in Hercules region, 253, 255-58, 262-63, 273  
 Voids, 245-94, 586, 633, 667-71  
 content of, 262-63  
 dendrogram analysis for identifying, 266-67, 276-78  
 dynamical evolution of, 279-81  
 in Galaxy, 245-46  
 extragalactic, identification of, 245-46  
 origin of, 281-83  
 point-smoothing analysis of, 278-79  
 in rich clusters, 669-70  
 statistical probability studies for identifying, 274-76  
 V693 Coronae Australis, 384  
 V1229 Aquilae, 379-82, 395  
 V1301 Aquilae, 379, 382, 395  
 V1370 Aquilae, 379, 383, 396, 398, 404-5  
 V1500 Cygni, 378-79, 382, 385-87, 393, 395-97, 403-4  
 V1668 Cygni, 379, 383, 396  
 V1819 Cygni, 384, 393  
 V4021 Sagittarii, 379, 382  
 V4077 Sagittarii, 399

Westerbork Synthesis Radio Telescope, 307

White dwarfs	MISCELLANEOUS	
in globular clusters, 233–37	3C 2, 116	3C 345, 124–25, 132, 135
as progenitors of novae, 37/–78, 394, 398–99, 401, 405	3C 31, 117	3C 380, 122
as progenitors of Type Ia supernovae, 311–12, 314	3C 33, 104, 118	3C 433, 110
WIMPs, 225–26	3C 58, 318	3C 449, 113, 116
W 44, 332–33	3C 61.1, 104	3C 454.3, 124
W 50, 322, 326, 335–36	3C 66A, 120	3C 465, 108, 110
XYZ	3C 66B, 108, 114, 116	4C 26.42, 116
X-radiation, solar, 474, 483–84, 492–93	3C 68.1, 120	4C 29.30, 116
X-ray observations of clusters of galaxies, 653–54	3C 79, 114	0235+164, 129
Zwicky clusters	3C 84 (NGC 1275), 108, 110, 114, 120	0521–365, 120
catalog of, 261, 637–38	3C 120, 110, 124	0716+714, 126
spatial correlation function of, 650–51, 653	3C 129, 108	0727–115, 128–29
	3C 171, 116	0735+178, 124, 133
	3C 179, 117	0752+258, 120
	3C 219, 112	0800+608, 108
	3C 272.1, 114	0846+513, 134
	3C 273, 118–20, 125, 133	0957+561, 114
	3C 277.3, 116, 118	1156+295, 134
	3C 279, 125, 127	1313+073, 108
	3C 305, 116	1400+162, 120, 134
	3C 310, 108	1418+546, 132
	3C 340, 108	1510–089, 129
		1759+211, 110
		1919+479, 108, 110
		2134+004, 128